

## Cryoballoon pulmonary vein isolation prior to percutaneous atrial septal defect closure: a case report

### Perkütan atriyal septal defekt kapatılması öncesi kriyobalon ile pulmoner ven izolasyonu: Olgu sunumu

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**Summary**— We report the case of a 61-year-old female who was admitted to our department with progressive dyspnea and palpitation. Transthoracic echocardiography and transesophageal echocardiography showed a small atrial septal defect (ASD, 8x7 mm). Paroxysmal atrial fibrillation (AF) was detected in Holter monitoring. As repair of ASD does not significantly reduce the risk of arrhythmias, cryoablation of AF was performed prior to ASD closure. On cardiac examination at one year, this combined intervention improved right ventricular function and prevented AF episodes.

**Özet**— Altmış bir yaşında kadın hasta giderek artan nefes darlığı ve çarpıntı şikâyetleri ile polikliniğimize başvurdu. Transtorasik ve transözofajiyal ekokardiyografi ile küçük boyutta atriyal septal defekt (ASD) (8x7 mm) saptandı. Holter monitörizasyonunda ise atriyum fibrilasyonu (AF) atakları görüldü. ASD'nin kapatılması tek başına aritmi riskini ortadan kaldırmayacağı için kriyobalon ile AF ablasyonu uygulandı. Birinci yıl kontrolünde sağ ventrikül boyut ve fonksiyonlarında iyileşme sağlandığı ve AF ataklarının önlenildiği görüldü.

Atrial arrhythmias are common in patients with atrial septal defect (ASD),<sup>[1]</sup> and the incidence of arrhythmia is similar before and after percutaneous ASD closure.<sup>[2]</sup> Pulmonary vein isolation (PVI) has become

#### Abbreviations:

AF	Atrial fibrillation
ASD	Atrial septal defect
LA	Left atrium
PV	Pulmonary vein
PVI	Pulmonary vein isolation
RF	Radiofrequency
TEE	Transesophageal echocardiography

an established treatment for patients with atrial fibrillation (AF). Cryoballoon PVI has evolved into a relatively simple alternative for point-by-point radiofrequency ablation.<sup>[3]</sup> Although the optimal

management for treating AF in patients with ASD has been debated, the current recommendation is intraoperative Maze procedure for patients undergoing surgical ASD repair if there is a history of AF.<sup>[4]</sup> Through technological improvements and increased experience, cryoballoon PVI can be performed before percutaneous closure of ASD. Thus, we present a case report of simultaneous cryoballoon PVI and ASD closure.

#### CASE REPORT

A 61-year-old female was admitted to our institution due to recurrent episodes of palpitations, chest pain, and shortness of breath, and documented paroxysmal AF episodes on the Holter recording. Previous pharmacological treatment that included propafenone and amiodarone was unsuccessful in controlling symptomatic AF episodes. Her medical history included hypertension, hyperlipidemia, and hypothyroidism (Hashimoto's), which were treated with irbesartan, atorvastatin, and levothyroxine, respectively. On admission, her physical examination, blood tests with thyroid function, and electrocardiogram showed normal findings. Transthoracic echocardiography provided the following information: normal left ventricular ejection fraction, mild dilatation of the left and right atrium, moderate tricuspid regurgitation (estimated pulmonary arterial systolic pressure was

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45 mmHg), and interatrial septal aneurysm.

Color Doppler image showed abnormal flow from the left to right atrium through the interatrial septum. Transesophageal echocardiography (TEE) revealed an 8-mm secundum ASD with adequate margins for deployment of a percutaneous closure device (Fig. 1a). PV anatomy was assessed in detail by computed tomography, showing normal left superior and inferior PVs (~19 mm in caliber), right superior (~20 mm) and very small caliber right inferior PV, and secundum ASD (Fig. 1b). Computed tomography also revealed non-significant coronary plaques in the circumflex and left anterior descending coronary artery.

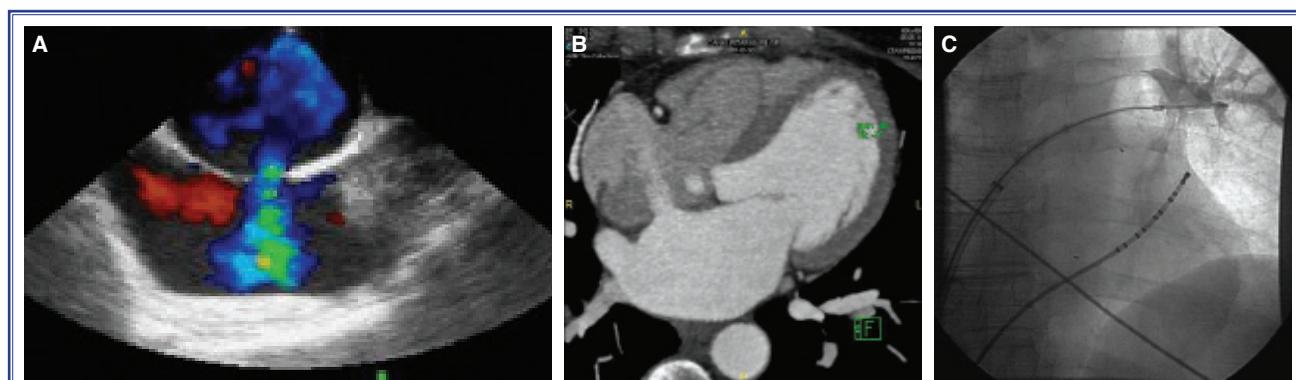
The patient was taken to the cardiac catheterization laboratory. After general anesthesia, a 12F Flex-Cath steerable sheath (Medtronic Inc., Minneapolis, MN, USA) was advanced into the left atrium (LA) over the wire without transseptal puncture. An Arctic Front, 28-mm double-lumen cryoballoon catheter (Medtronic), as appropriate for the diameter of the PV, was introduced inside the 12F sheath. We applied two ablation freezes, between 240 and 400 s, with good balloon occlusion (Fig. 1c). PV mapping with 20-pole Lasso catheter (Biosense-Webster Inc., Johnson & Johnson Company, Diamond Bar, CA, USA) was performed following ablation of all three PVs, showing complete PV isolation in all three PVs (Fig. 2). Complete elimination of PV electrical activity was determined by bidirectional conduction block between the LA and PVs. No electrical activity was detected in the right inferior PV with Lasso catheter, and hence, cryoablation was not performed.

After PV isolation, the diameters of the interatrial defect were measured on two-dimensional TEE images in various planes, and a 12-mm Figulla ASD occluder device (Occlutech GmbH, Jena, Germany) was implanted without balloon sizing of the defect. Secure and stable positioning of the device within the defect was checked through a push-pull maneuver. After deployment of the device from the cable by unscrewing it, a final TEE examination with agitated saline demonstrated good positioning of the device and no residual shunting (procedure time 95 minutes; fluoroscopy time 23 minutes). The patient was subsequently treated with propafenone 150 mg twice a day for one month and dual antiplatelet therapy after ASD closure (Clopidogrel once a day for 6 months and acetylsalicylic acid 100 mg once a day lifelong).

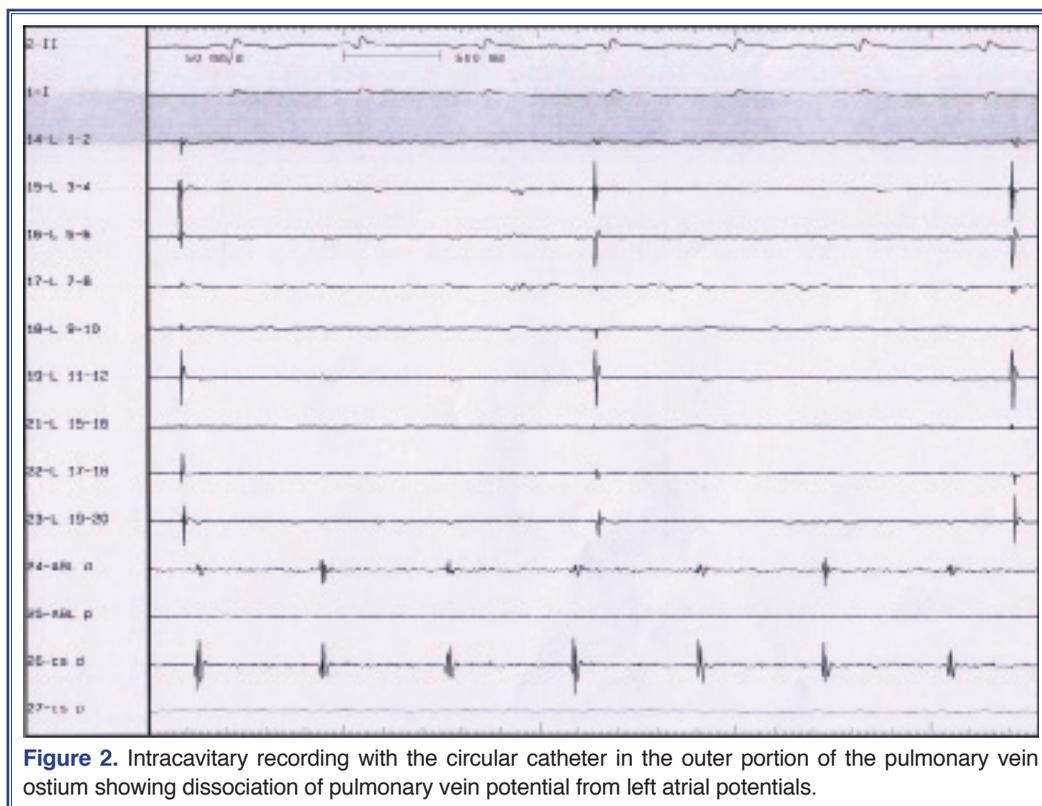
During the one-year follow-up, clinical evaluation and Holter monitoring did not demonstrate any atrial arrhythmias without antiarrhythmic drugs. In addition, it was detected by means of TTE that the closure device was well positioned without residual shunt, and pulmonary artery pressure decreased to normal range.

## DISCUSSION

Atrial fibrillation is the most common sustained cardiac arrhythmia, occurring in 1-2% of the general population.<sup>[5]</sup> As PVs were identified as major sources of ectopic beats, PV isolation has been considered as the cornerstone for paroxysmal AF procedures.<sup>[6]</sup> PV isolation strategies have been deployed with the intention of “curing” AF. Long-term follow-up studies



**Figure 1.** (A) Transesophageal echocardiography at the mid-esophageal level (transducer plane angle, 110°) demonstrating abnormal flow from the left to right atrium through the interatrial septum. (B) Preoperative visualization of an atrial septal defect by 64-slice cardiac computed tomography. (C) Balloon catheter occlusion showing retention of the contrast medium with the absence of atrial drainage due to complete occlusion.



suggest that sinus rhythm is better preserved with PV isolation than with antiarrhythmic drugs.<sup>[7]</sup> Cryoballoon AF ablation seems to be a useful and safe method in the treatment of paroxysmal and persistent AF, providing an alternative approach to radiofrequency (RF) current AF ablation. The long-term success rate has been high and is favorably consistent with that attained with RF ablation.<sup>[8]</sup> Although the incidence of AF increases with age even in the general population, in patients with ASD, the incidence of AF is strikingly high, even after surgical closure.<sup>[9]</sup> In the previous study, the incidence of AF was 13% prior to surgery and 10% afterwards in patients who underwent surgical closure of ASD. Recently, Oliver et al.<sup>[10]</sup> demonstrated that advanced age is the most important condition related to the presence of AF in patients with ASD both before and after surgical closure. Furthermore, they also noted that the development of atrial arrhythmia in patients with ASD occurs earlier than in the general population. The proposed etiology is considered as right atrial stretch secondary to the hemodynamic changes of the ASD. Closure of the ASD decreases volume overload and can result in reverse remodeling in the atrium. However, atrial reverse

remodelling rarely brings about complete resolution of atrial arrhythmias once they have become established.<sup>[11]</sup> Accordingly, it appears that the mechanism responsible for triggering atrial arrhythmias might be different from hemodynamic changes. As repair of ASD does not significantly reduce the risk of arrhythmias, current guidelines point out that concomitant Maze procedure may be considered for intermittent or chronic atrial tachyarrhythmias in adults with ASD.<sup>[12]</sup>

Although previous data show that percutaneous AF ablation is feasible and safe in the subset of patients with previous surgical or percutaneous ASD closure, transseptal puncture can be difficult because of the issue of LA access.<sup>[13]</sup> In a recent study, intracardiac echo-guided transseptal access was obtained in 98% of patients with previous ASD or patent foramen ovale closure. Among those with closure devices, the LA was accessed inferoposteriorly through a septal puncture in the periphery of the device.<sup>[14]</sup>

In contrast, LA access in a patient with an unrepaired ASD is comparatively easy and rarely requires specialized access tools. With the advent of percutaneous techniques, cryoballoon PVI can be performed

prior to percutaneous ASD closure to avoid an open chest surgical approach for patients with ASD and atrial arrhythmias. According to the referred publications and based on several advantages, we chose simultaneous repair including cryoballoon PVI and ASD closure.

Improvement in percutaneous techniques prevents more invasive and surgical procedures, especially in cardiac interventions. The present case report indicates that cryoballoon PVI prior to percutaneous ASD closure can be performed easily and can prevent several difficulties and complications.

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**Key words:** Atrial fibrillation; atrial septal defects; catheter ablation; catheterization/methods; cryosurgery/methods.

**Anahtar sözcükler:** Atriyum fibrilasyonu; atriyal septal defekt; kateter ablasyonu; kateterizasyon/yöntem; kriyocerrahi/yöntem.